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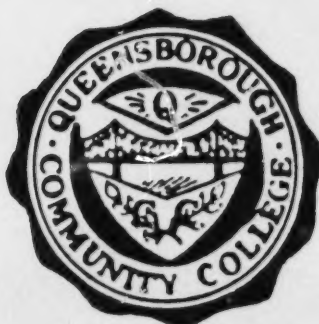
ABSTRACT

A study was conducted at Queensborough Community College to determine if observational, laboratory, and educational activities at an astronomical observatory housing a 12-inch Cassegrain telescope enhanced the attitudes of students enrolled in Physics 110 (The Principles of Astronomy and Science). Two groups of students were involved in the study: a control group consisting of 263 students enrolled in Physics 110 during Spring 1979 (before use of the observatory was made part of the course) and an experimental group consisting of 144 students enrolled in the course in Spring 1980 (after the observatory was made available). Each group was administered a Science Attitude Survey (SAS) at the beginning and end of the course. They were asked to rate, on a five-point scale, their agreement with nine statements about their present and future interest in science and astronomy. The survey data were then statistically analyzed to determine the significant differences, if any, between the pre- and post-test scores of the two groups. Neither group's attitudes registered a statistically significant change on the pre- and post-tests, nor were the experimental group's attitudes significantly different than those of the control group. The study report details methodology and findings and is appended by the SAS and raw and statistical data. (JP)

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ATTITUDE TOWARD SCIENCE AND ASTRONOMY



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QUEENSBOROUGH COMMUNITY COLLEGE
THE CITY UNIVERSITY OF NEW YORK
BAYSIDE, NEW YORK 11364
1980

7/80

JC 810463

Prepared by

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QUEENSBOROUGH COMMUNITY COLLEGE
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ATTITUDE TOWARD SCIENCE AND ASTRONOMY

The purpose of this study was to determine whether attitudinal changes toward science and astronomy occurred with the adoption of the new Physics 110 curriculum. The Science Attitude Survey (SAS) questionnaire was administered as a pretest and posttest to students enrolled in Principles of Astronomy and Space (Physics 110) at Queensborough Community College (QCC) during the 1979 and 1980 spring semesters.

In the interim, during the fall 1979 semester, an astronomical observatory housing a 12-inch Cassegrain telescope was opened, and became an integral part of the Physics 110 course. Observational, laboratory and educational activities related to the observatory were incorporated into the new Physics 110 curriculum.

Data collected during Spring 1979 semester prior to the course innovation, served as a bench mark; data were again collected in Spring 1980 when students in Physics 110 received the entire curricular treatment.

THE INSTRUMENT:

The SAS questionnaire (see Appendix A) was developed by the QCC Office of Testing and Institutional Research in cooperation with the Department of Physics project director and the National Science Foundation.

The SAS was initially field tested in the classroom to determine the clarity of test instructions and items. As a result of the field test eleven items remained out of 17 original items in the final version and four new items were added making a total of fifteen. Standardized instructions to administer the SAS were developed. (See Appendix B), Reliability was estimated to be .93 (Coefficient Alpha:N=127); validity data are not available.

THE SAMPLE:

During the Spring '79 semester, the SAS questionnaire was administered as a pretest and posttest to 263 students in five Physics 110 astronomy classes taught by five different instructors. During the Spring '80 semester 144 students were pre and posttested in four classes taught by four different teachers. Two of seven teachers were involved in both base-line and treatment semesters.

Respondents from samples in both semesters were quite similar with respect to age, sex, curriculum and reason for taking the course. (See Table 1.)

Table 1
Demographic Variables of Samples by Semester

Variables	(Control) Spring 1979	(Experimental) Spring 1980
Median Age	19.7	19.5
LA Curriculum	27.6	29.8
Sex (Male%/Female%)	50/50	50/50
Course Required/Course Elected	77.9/22.1	69.2/30.8

THE ANALYSIS:

The responses to each item were weighted as follows:

<u>Response</u>	<u>Weight</u>
Strongly Agree	5
Agree	4
Undecided	3
Disagree	2
Strongly Disagree	1

The total score is the sum of weights of responses to all 15 items. The highest possible total score is 75 and the lowest is 15 if all items are answered.

Pretest-posttest statistical comparisons were conducted.

The results are shown in Table 2.

Table 2
Comparison of Pretest and Posttest Total Scores
on Science Attitude Survey

<u>Spring 1979 (N=110):</u>	<u>X</u>	<u>SD</u>	<u>correlated t</u>
Pretest Total Score	50.23	9.69	.22 NS*
Posttest Total Score	50.03	11.51	
<u>Spring 1980 (N=69):</u>			
Pretest Total Score	46.9	11.7	1.36NS*
Posttest Total Score	45.3	11.6	

*NS=Not significant at the .05 level.

It is apparent from the results of the significance tests in Table 2, that the pretest-posttest mean differences for both semesters were not statistically significant.

Comparison of pretest means by groups is shown in Table 3.

Table 3
Group Comparisons of Total Scores on Pretests

<u>Semester</u>			
<u>Variables</u>	<u>Sp '79 (Control)</u>	<u>Sp '80(Experimental)</u>	<u>t</u>
<u>Pretests:</u>			
Mean	50.34	47.62	2.38*
SD	9.87	11.13	
N	231	127	

* Significant at the .05 level.

The data in Table 3 indicate a significant initial difference between the pretest mean of the base line group (Sp '79) and the pretest mean of the experimental group (Sp '80).

To statistically remove the pre-existing differences between these two groups an Analysis of Covariance (see Table 4) was employed. The pretest total scores served as the covariate on the posttest criterion total score variable.

Table 4

Analysis of Covariance of Sp. '79 & Sp. '80
Groups Using Pretest Scores as a Covariate
on the Posttest Criterion Variable

Source of Variation	SS	DF	MS	F	Significance
Covariate: (Pretest)	9689.47	1	9689.47	116.17	.001*
Main Effects: (Sp '79 vs. Sp '80 Groups)	255.47	1	255.47	3.06	.082NS
Explained:	9944.94	2	4972.47	59.62	.001*
Residual:	14679.26	176	83.405		
Total:	24624.20	178	138.338		

* Significant at the .05 level.
NS Not significant at the .05 level.

Table 4 indicates that the covariate contributed a significant amount of explained variance ($p < .05$): group membership (Sp '79 or Sp '80) was not significant ($p > .05$).

Table 5 presents the means of both groups adjusted by the analysis of covariance.

Table 5

Comparison of Adjusted Means
of the Sp '79 & Sp '80 Groups

Group	N	Unadjusted Means	Adjusted Means	F	Significance of F
Sp '79	110	50.03	49.18	3.06	NS*
Sp '80	69	45.34	46.69		

*NS=Not significant at the .05 level.

In an analysis of covariance comparison of both groups for each item no statistically significant differences were found except for item 2, "I plan to take more courses in Science after Astronomy." (See Appendix C) For this item, the adjusted posttest mean of the Spring '79 control group ($\bar{X} = 2.78$, $N=110$) was significantly higher statistically than the mean of the Spring '80 experimental group ($\bar{X} = 2.46$, $N=69$). Response percentages for each item are shown in Appendix D.

SUMMARY:

Given the data in Tables 2 and 3, it seems that neither group's attitude, (the control group of Spring '79 nor the experimental group of Spring '80) registered a statistically significant positive change in attitude as measured by the SAS.

When the posttest means of the control and experimental groups were compared on total SAS scores no significant difference was found. (See Tables 4 and 5)

In an item by item comparison between groups only item two showed a statistically significant difference but not in the predicted direction.

QUEENSBOROUGH COMMUNITY COLLEGE
THE CITY UNIVERSITY OF NEW YORK

SCIENCE ATTITUDE SURVEY

SOCIAL SECURITY NUMBER: _____ SEX: F. _____ M. _____ AGE: _____
(1-9) (11) (13-14)

CURRICULUM (Major) _____ COURSE/SECTION _____ DATE: ____/____/____
(16-17) (19-23) (25-30)

THIS COURSE IS:

- | | | |
|-----|--------------|---------------------------------|
| [] | Required: | I am majoring in this area. |
| [] | Required: | I am NOT majoring in this area. |
| [] | An Elective: | I am majoring in this area. |
| [] | An Elective: | I am NOT majoring in this area. |

(32)

The following items are not designed to test your knowledge. Instead, they are meant to explore some of your feelings and points of view toward science. There are no right or wrong answers. Further, your responses will not be made known to other students nor will they be used for grading purposes in this course. Your Social Security number will be used only for statistical purposes. Please give a thoughtful and honest response to each item.

Please circle the statement which best expresses your opinion:

SA=STRONGLY AGREE A=AGREE U=UNDECIDED D=DISAGREE SD=STRONGLY DISAGREE

1. I am interested in Science:

SA A U D SD (34)

2. I plan to take more courses in Science after Astronomy:

SA A U D SD (35)

3. I like studying Science:

SA A U D SD (36)

4. I am afraid to take a Science course:

SA A U D SD (37)

5. I enjoy reading books or articles on Astronomy:

SA A U D SD (38)

6. I enjoy watching TV programs and films on Astronomy:

SA A U D SD (39)

7. I would enjoy doing Astronomy laboratory experiments:

SA A U D SD (40)

8. Doing a scientific research project would be interesting:

SA A U D SD (41)

9. Astronomy courses inspire me to continue my education:

SA A U D SD (42)

10. The day after day search for scientific knowledge would become boring:

SA A U D SD (43)

11. Working in a laboratory would be an interesting way to earn a living:

SA A U D SD (44)

12. I am interested in Astronomy:

SA A U D SD (45)

13. I plan to take more courses in Astronomy:

SA A U D SD (46)

14. I would like to use a telescope:

SA A U D SD (47)

15. Working in an Astronomical Observatory would be an interesting way to earn a living:

SA A U D SD (48)

THANK YOU FOR YOUR COOPERATION

APPENDIX B

QUEENSBOROUGH COMMUNITY COLLEGE
OF THE CITY UNIVERSITY OF NEW YORK

OFFICE OF TESTING AND INSTITUTIONAL RESEARCH

M E M O R A N D U MTO:DATE:FROM: Dr. Edward G. Cohen, DirectorSUBJECT: Administration of Science Attitude Survey

Please administer the attached Science Attitude Survey questionnaires to your PH-110 classes both as a pretest and post-test. (Lecture sections only.)

The pretest should be administered at the first class meeting with the following standardized instructions:

PLEASE READ ALOUD:

"The faculty in the Physics Department would like to know how you feel about science and astronomy. Please fill out the requested information on the top of the Science Attitude questionnaire. (Allow students time to complete top of Questionnaire.)

CONTINUE READING ALOUD:

Now, please read the instructions on the questionnaire to yourself as I read them aloud.

"The following items are not designed to test your knowledge. Instead, they are meant to explore some of your feelings and points of view toward science. There are no right or wrong answers. Further, your responses will not be made known to other students nor will they be used for grading purposes in this course. Your Social Security number will be used only for statistical purposes. Please give a thoughtful and honest response to each item.

CONTINUE READING:

"Please circle the statement which best expresses your opinion:

SA=STRONGLY AGREE A=AGREE U=UNDECIDED D=DISAGREE SD=STRONGLY DISAGREE"

FACULTY NOTE:

Please follow the same procedure for the posttest to be administered at the end of the semester prior to the final examination.

Please return all questionnaires directly to the Office of Testing, Rm. L-431. If you have any questions, please feel free to call me. Many thanks for your cooperation.

EGC:smr

cc: Dean Alterman
Dean Karle

APPENDIX C

Analysis of Covariance By Items and Groups Using Pretest
Item Score as Covariate and Posttest Item Score as Criterion

Item	Adjusted $\bar{X}$		R^2 (%)	F	Significance of F
	Sp '79 (Control)	Sp '80 (Exp.)			
1	3.66	3.40	22	3.39	.067
2	2.78	2.46	31	4.89	.028 *
3	3.42	3.16	32	3.70	.056
4	3.75	3.53	12	1.52	.167
5	3.68	3.50	28	1.70	.194
6	3.81	3.60	34	2.84	.094
7	3.14	3.12	22	.007	.993
8	3.11	3.13	30	.017	.896
9	2.68	2.60	24	.153	.696
10	3.42	3.18	13	2.18	.142
11	3.08	2.87	34	2.44	.121
12	3.80	3.49	21	2.88	.092
13	2.73	2.55	33	2.05	.154
14	3.98	3.78	23	2.40	.123
15	3.20	3.14	30	.195	.659

* = Significant at the .05 level.

APPENDIX D

Percentage Analysis of Items By Semester and Group Comparisons

Item	Weight:	5	4	3	2	1	$\bar{X}$	N
	SA	A	U	D	SD			
1. I am interested in Science:								
<u>Spring '79:</u>								
Pretest	16.5	43.4	22.9	10.8	0.4	3.62	356	
Posttest	17.0	53.2	16.3	9.9	3.5	3.55	227	
<u>Spring '80:</u>								
Pretest	11.2	50.4	18.4	15.2	4.8	3.48	125	
Posttest	5.8	50.0	19.8	18.6	5.8	3.31	86	
2. I plan to take more courses in Science after Astronomy:								
<u>Spring '79:</u>								
Pretest	8.2	9.1	37.7	29.9	15.2	2.60	358	
Posttest	8.5	17.0	36.2	22.7	15.6	2.60	227	
<u>Spring '80:</u>								
Pretest	5.5	12.6	33.1	23.6	25.2	2.50	127	
Posttest	1.2	8.1	34.9	27.9	27.9	2.27	86	
3. I like studying Science:								
<u>Spring '79:</u>								
Pretest	12.1	43.3	29.9	12.6	2.2	3.41	358	
Posttest	12.1	48.9	19.9	14.9	4.3	3.33	227	
<u>Spring '80:</u>								
Pretest	6.3	44.9	22.8	16.5	9.4	3.20	127	
Posttest	3.5	39.5	22.1	29.1	5.8	3.06	86	
4. I am afraid to take a Science course:								
<u>Spring '79:</u>								
Pretest	27.1	41.0	14.4	11.4	6.1	3.70	356	
Posttest	26.1	39.4	16.2	12.0	6.3	3.61	228	
<u>Spring '80:</u>								
Pretest	20.5	48.0	12.6	17.3	1.6	3.69	127	
Posttest	16.3	45.3	19.8	11.6	7.0	3.52	86	

APPENDIX B

(Continued)

Item	Weight:	5	4	3	2	1	$\bar{X}$	N
		SA	A	U	D	SD		
5. I enjoy reading books or articles on Astronomy:								
Spring '79:								
Pretest		14.7	45.9	27.3	9.1	3.0	3.53	358
Posttest		15.6	54.6	19.9	5.0	5.0	3.59	227
Spring '80:								
Pretest		12.6	40.2	27.6	13.4	6.3	3.39	127
Posttest		12.8	47.7	17.4	10.5	11.6	3.40	80
6. I enjoy watching TV programs and films on Astronomy:								
Spring '79:								
Pretest		20.7	52.9	16.3	8.8	1.3	3.72	352
Posttest		23.9	51.4	17.4	5.8	1.0	3.77	220
Spring '80:								
Pretest		12.8	50.4	17.6	14.4	4.8	3.52	125
Posttest		18.3	43.9	18.3	13.4	6.1	3.55	82
7. I would enjoy doing Astronomy laboratory experiments:								
Spring '79:								
Pretest		11.9	42.7	37.0	5.7	2.6	3.48	353
Posttest		10.9	38.0	21.2	22.6	7.3	3.15	219
Spring '80:								
Pretest		10.3	34.9	38.9	11.1	4.8	3.35	126
Posttest		6.1	35.4	25.6	20.7	12.2	3.02	82
8. Doing a scientific research project would be interesting:								
Spring '79:								
Pretest		8.4	33.6	35.8	16.4	5.8	3.07	352
Posttest		10.2	37.2	28.5	13.9	10.2	3.11	219
Spring '80:								
Pretest		5.6	23.8	31.0	24.6	15.1	2.80	126
Posttest		7.3	20.7	40.2	18.3	13.4	2.90	82

APPENDIX D

(Continued)

	Weight:	5	4	3	2	1	$\bar{X}$	N
Item		SA	A	U	D	SD		
9. Astronomy courses inspire me to continue my education:								
<u>Spring '79:</u>								
Pretest	4.0	16.7	38.8	35.7	4.8	3.67	353	
Posttest	6.6	16.8	32.8	31.4	12.4	2.63	218	
<u>Spring '80:</u>								
Pretest	2.4	15.9	27.8	33.3	20.6	2.46	126	
Posttest	1.2	17.3	27.2	33.3	21.0	2.44	81	
10. The day after day search for scientific knowledge would become boring:								
<u>Spring '79:</u>								
Pretest	15.0	35.7	30.4	15.9	3.1	3.40	353	
Posttest	16.8	36.5	25.5	15.3	5.8	3.31	219	
<u>Spring '80:</u>								
Pretest	14.3	31.7	30.2	19.8	4.0	3.33	126	
Posttest	13.4	26.8	25.6	25.6	8.5	3.11	82	
11. Working in a laboratory would be an interesting way to earn a living:								
<u>Spring '79:</u>								
Pretest	6.2	26.1	34.5	28.3	4.9	2.99	352	
Posttest	11.8	23.5	36.0	25.0	3.7	3.05	218	
<u>Spring '80:</u>								
Pretest	5.6	30.2	30.2	23.8	10.3	2.97	126	
Posttest	4.9	31.7	24.4	25.6	13.4	2.89	82	
12. I am interested in Astronomy:								
<u>Spring '79:</u>								
Pretest	14.1	57.3	22.5	6.2	0.0	3.70	353	
Posttest	15.3	59.1	14.6	8.0	2.9	3.62	188	
<u>Spring '80:</u>								
Pretest	9.5	54.0	24.6	4.8	7.1	3.54	126	
Posttest	9.8	47.6	19.5	18.3	4.9	3.39	82	

APPENDIX D

(Continued)

Item	Weight:	5	4	3	2	1	$\bar{X}$	N
		SA	A	U	D	SD		
13. I plan to take more courses in Astronomy:								
<u>Spring '79:</u>								
Pretest		3.1	7.5	54.6	27.3	7.5	2.63	352
Posttest		6.5	11.6	50.0	27.7	10.1	2.67	220
<u>Spring '80:</u>								
Pretest		2.4	7.2	43.2	30.4	16.8	2.48	125
Posttest		1.2	8.5	41.5	26.8	22.0	2.40	82
14. I would like to use a telescope:								
<u>Spring '79:</u>								
Pretest		28.6	59.5	10.1	1.8	0.0	4.11	353
Posttest		28.3	59.4	5.8	4.3	2.2	3.97	220
<u>Spring '80:</u>								
Pretest		30.2	50.0	15.9	2.4	1.6	4.05	126
Posttest		20.7	52.4	15.9	8.5	2.4	3.81	82
15. Working in an Astronomical Observatory would be an interesting way to earn a living:								
<u>Spring '79:</u>								
Pretest		11.9	31.3	36.6	15.9	4.4	3.28	352
Posttest		13.9	33.6	29.2	17.5	5.8	3.24	218
<u>Spring '80:</u>								
Pretest		9.6	32.0	38.4	12.0	8.0	3.23	125
Posttest		8.6	38.3	19.8	22.2	11.1	3.11	81

NS = Not significant at the .05 level.

* = Significant at the .05 level.

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